confident that the ability of the investigator will eventually enable him to right himself and find his way out of the woods into the clear light of some important truth as yet unknown to us all.

If, on the other hand, the Editor sometimes rejects a communication in which imagination is more prominent than the facts, or in which the facts have been distorted so as to appear to support a preconceived theory, this may be because meteorology is overburdened with ill-founded notions, and students must be discouraged from pursuing really foolish or unimportant lines of work while the important problems of meteorology are almost neglected on account of their difficulty.

The Monthly Weather Review is therefore a medium for honest, rational discussion of every important problem of meteorology, whether it be approached from the statistical, the experimental, or the mathematical side. It is not carrying on an unreasonable propaganda.—*C. A.*

DIURNAL VARIATION OF THE BAROMETER.

An article in Gaea, for August, 1905, by Doctor Korselt, of the Realgymnasium, or high school, at Annaberg, Germany, on the causes of the diurnal oscillation of the barometer, attempts to show how this oscillation is an important link in the chain of phenomena that results from the unequal warming of our atmosphere by insolation, and its unequal cooling by radiation. This paper is an elaboration of one presented by Doctor Korselt, in 1893, to the International Meteorological Congress at Chicago.

Korselt develops the idea that the atmosphere may be considered as a heat engine, maintained in operation by the periodical accession of solar heat, in which the motion of the atmosphere is the work that is done. The location of the driving force, analogous to a steam boiler, is in the Tropics. The pushing of the hot air from the Torrid Zone toward either pole, and its return as cold air, is renewed daily by the rotation of the earth, and is analogous to the expansion and contraction of the steam cylinder. His memoir of 1905 develops this conclusion in a popular way, without the ordinary formulas of mechanics; and he also concludes that the minute study of the daily barometric oscillation can be of great value for practical forecasting, because it ought to give us information about conditions in the atmosphere at altitudes which balloons have not yet been able to attain. If, for instance, we compiled a daily weather chart, showing the observed difference between the barometric ranges by day and by night (that is to say, the day range between the 10 a. m. maximum and the 4 p. m. minimum, and also the night range between the 10 p. m. maximum and the 4 a. m. minimum), we shall, he thinks, probably find that any temporary area of low pressure has a tendency to move toward the region where this difference of the ranges is a minimum.

The application of Korselt's rule can probably be tested in the United States better than in any other part of the world, since every regular station has its self-recording barometer, and could easily telegraph every morning the extent of the day range and night range during the preceding twenty-four hours. On the other hand these ranges are so small, and often so completely covered up by the nonperiodic changes, that relatively very large and misleading errors would seem to be inevitable.—*C. A.*

INFLUENCE OF THE OCEAN ON CONTINENTAL PRECIPITATION.

In a recent paper before the Société Helvétique des Sciences Naturelles on the interchange of moisture between land and sea,[1] Prof. Dr. Ed. Brückner estimates that 93 per cent of all the water evaporated from the ocean is returned to it in the form of precipitation, leaving but 7 per cent available for distribution over the land surface. Of the total precipitation over the land, 20 per cent is supplied directly by the ocean, while the remaining four-fifths is the recondensation of vapor evaporated from the continents.

Professor Brückner's figures appear to be based upon the following approximate data:

1. Total evaporation from the sea, 384,000 cubic kilometers.
2. Total precipitation upon the land surface, 122,000 cubic kilometers.
3. Total volume of water returned to the sea by rivers, 24,000 cubic kilometers.

It is evident that in the long run as much water must be returned to the ocean as is taken from it. We may consider that this water is returned to the ocean in three ways: (*a*) by precipitation of water evaporated from the ocean surface; (*b*) by precipitation of water evaporated from the land and carried by winds over the ocean; (*c*) by rivers.

The rivers, therefore, are the means by which the land returns to the ocean all of the oceanic waters carried over the land and not returned in the form of aqueous vapor (as given under *b* above), and the total volume of the rivers therefore represents the difference between the amount of vapor passing from the sea over the land and that passing from the land over the sea.

By subtracting the third quantity from the first, we obtain the total precipitation over the ocean, while the difference between the second quantity and the third gives the land precipitation due to evaporation from the land.

If we might depend upon the accuracy of these figures and the underlying assumptions, it would appear that were the influence of the oceans eliminated the continents would still receive four-fifths of their present precipitation. But it is obvious that the three quantities above given are derived from measurements both incomplete and inexact. The accurate determination of evaporation is a problem that much investigation has never solved. Of the total discharge of the Amazon, the largest of rivers, and of the rainfall in its sparsely inhabited basin we have but a vague idea. The large rivers of China have never been systematically measured, and the same is true of the precipitation over extensive provinces of this secluded country. Africa has many regions as yet guiltless of the rain gage and rivers unstudied by the hydrographic engineer. In all countries numerous smaller streams, individually too unimportant to demand investigation, augment by a considerable total annual volume the waters of the sea. With the spread of civilization and the increased application of scientific methods to practical ends, we may hope to approximate closer and closer to the true values of such large factors as Professor Brückner considers. In the meantime, his figures may be provisionally accepted as indicating that the direct influence of the ocean upon continental precipitation is less than has been generally supposed.—*F. O. S.*

PRESSURE AND RAINFALL OVER THE INDIAN MONSOON AREA.

Dr. W. L. Dallas, first assistant of the Indian Meteorological Office, has presented to the American Philosophical Society a memoir on the above subject, of which an abstract is published in the proceedings of that society, Vol. XLIV, pages 159-163, from which we quote the following:

> The investigation has brought out certain relationships which appear at least worthy of record. The tentative conclusions arrived at are as follows:
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> (1) That over the trades-monsoon area, and most markedly so over the equatorial belt, there occur four-year oscillations of pressure; (2) that during the rising portions of these oscillations the *general* rainfall of the trades-monsoon area is below, and during the falling portions is above the average, with a well-marked minimum of rainfall in the first year of the cycle and a well-marked maximum of rainfall in the third year; (3)

[1] Sur le bilan du cycle de l'eau sur la terre. Archives des sci. phys. et nat. Genève, Oct., 1905. Tome 20, p. 427-30.

that from the Antarctic, or extreme southern regions, there emanate at irregular intervals rays or streamers, of varying extent and intensity, which occasion increased atmospheric pressure over the affected area; (4) these rays, or streamers, are apparently not in the least in the nature of waves, as they affect large areas practically simultaneously and continue for considerable periods; (5) when these rays, or streamers, are frequent and extensive, as in portions of the years 1899 and 1900, the pressure ranges largely above the normal, but exhibits large oscillations or fluctuations; when, on the contrary, they are absent, as in portions of the years 1898 and 1899, the pressure is low and the oscillations small; (6) these variations are superposed on the four-year cycle of the tropical belt, and are spasmodic, occurring at intervals over irregular areas, so that their influence occasions irregular variations of rainfall and irregularities in the pressure cycles.

There appears to be no satisfactory explanation either of the four-year cycle of pressure over the trades-monsoon area or of the irregular spasmodic disturbances of pressure referred to above. With regard to the cycles it is possible that compensatory actions are at work, so that when atmospheric pressure increases in one part of the world it decreases in another; though the evidence of the barometry of the United States is opposed to this, and rather suggests that the principal secular variations of pressure are of a uniform character over the whole globe. It is impossible to believe that the variations of pressure are a result of variations of rainfall. For one thing the variations are as marked in a dry area like Aden as in a wet area like Bombay, and for another the evidence, so far as it can be sifted, shows that the variations of pressure *precede* the variations of rainfall. Thus the increase of pressure which culminated in the large excess of pressure in the months of July, August, and September, 1899, commenced in February of that year, thus *preceding* by some months, and not *succeeding*, the scanty rainfall of that season.

Having had an opportunity of examining the original extensive manuscript of Mr. Dallas, the Editor feels some doubt as to whether a four-year cycle is sufficiently well established by this beginning of a research that in fact ought to include a larger area and a longer period of time than the seven years for which Mr. Dallas collected the necessary data.

It will be remembered that some years ago Hildebrandsson published a series of tables and charts showing the distribution of pressure over the whole globe, month by month, for ten years, and a few charts showing special types of distribution; from these it appears that not only is the atmosphere subject to areas of high pressure and low pressure that have long been known as subpermanent, namely, slowly changing conditions, but superposed upon these are departures from the monthly normals which are of the same nature over large portions of the globe, so that sometimes one-third or one-half of the isobars show an abnormal positive departure while the others show a negative. These areas of positive and negative departure seemed to Hildebrandsson to be subject to no law and no system of cyclic change, while the old-fashioned subpermanent areas first revealed by Buchan's maps do show appreciable systematic changes. But the idea expressed in the word "systematic," or "cyclic," or "periodic," often depends wholly upon our point of view. There can be no doubt but what the atmosphere obeys in every respect the laws of mechanics, and these must pervade the changes that seem to us so irregular. We can not expect to find many changes recurring after definite intervals of time, and therefore technically periodic. Even the diurnal and the annual periodic changes have a wide range of irregularity, most plausibly due to the action of the variable quantities of moisture and cloud in the atmosphere and the variable influences of the irregular contours of the respective continents. We may, however, understand that the reaction of continents and oceans on the atmosphere will introduce local peculiarities in the distribution of temperature, pressure, winds, and rain, and among these local peculiarities there will often appear something like a period as regards time, or a cycle of changes repeating themselves rather irregularly as regards location and time. Thus the tropical areas of high pressure over the north Atlantic and north Pacific are perpetually shifting about—north, or west, or east, or south—as well as increasing and diminishing as to their central maximum pressures. These shifts may be said to control the weather of the adjoining continental coasts. They were perceived promptly in the daily work of the Weather Bureau in 1871 and made the basis of improvements in what would otherwise have been rough forecasts of the weather. The movements of these areas of high pressure northward and southward were studied very satisfactorily by means of our daily simultaneous weather charts of the Northern Hemisphere, 1875–1889; in fact, the meteorologist, A. Poincaré, of the Meteorological Society of France, with much plausibility showed that the north-south motion was partially controlled by the monthly change of the moon in declination, although the larger part of the motion was due to the complex internal hydrodynamics of the earth's atmosphere.

The Editor has often pointed out that there is every reason to believe that all the important phenomena of climatology are the result of hydrodynamic and thermodynamic combinations within our atmosphere, and are not due to any external variation of the moon, or the radiation of the sun, or cosmic influences in general. To us cosmic meteorology, so called, is the fairy realm of the science, full of beautiful problems for the future, but far removed from the severe practical problems of terrestrial meteorology, and not to be cultivated by us until we have made better progress than now in the study of the atmosphere itself.

The geographic cycles and the chronologic periods that have been worked out by Hildebrandsson, Dallas, and others have their most pronounced development in that remarkable annual revolution by means of which the southeast trade winds of the southern Indian Ocean become the southwest monsoon of India and Cochin China. We do not expect that further study will show important new chronologic periods, but we may expect to find very important geographic cycles, such that, for instance, the droughts and floods of Australia and southern Asia and eastern Africa transmit their influences eastward over the North Pacific and find some slight response in North America. By an arrangement with Professor Hildebrandsson we have undertaken to extend his work, and hope eventually to publish the necessary series of charts for a period of about thirty years, so as to obtain a more correct view of these general phenomena and their relation to the internal economy or conservation of energy that characterizes our own atmosphere.—*C. A.*

VINCENT'S BIBLIOGRAPHY OF TREATISES ON METEOROLOGY.

The meteorological "Annuaire" of the Royal Observatory of Belgium has been published for nearly seventy years quite regularly. At first it was a combined *annuaire* for astronomy and meteorology, but since 1901 the two branches of science have been published separately, the latter under the care of Prof. A. Lancaster. In each annual volume, in addition to a large mass of tabular details relative to the climate of Brussels and meteorology in general, there are also several chapters of very general interest.

The volume for 1905 contains a contribution by E. Vanderlinden on the study of the frosts of spring and autumn, and a memoir by J. Vincent on the bibliography of treatises on meteorology; the latter occupies 45 pages. The author says that it frequently happens that persons who are desirous of posting themselves as to the present state of meteorology inquire what works are most to be recommended. This demand can perhaps best be answered by publishing a list of the best treatises in various languages. But such a list is much longer than one would expect; the various authors have written for a great variety of readers, from the most elementary books for children up to the more difficult technical treatises. It is therefore impossible to recommend any particular work unless one knows the capacity of the would-be reader. Consequently the latter should examine the general list of treatises and